GIBCO BRL®

Instruction Manual

Model S2 Sequencing Gel Electrophoresis Apparatus

CAT. SERIES 21105

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Warning:

1. Read and carefully follow the manual instructions.
2. Do not alter equipment. Failure to adhere to these directions could result in personal and/or laboratory hazards, as well as invalidate equipment warranty.

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Notices to Customer

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1.1 Important Information

This product is authorized for laboratory research use only. The product has not been qualified or found safe and effective for any human or animal diagnostic or therapeutic application. Uses for other than the labeled intended use may be a violation of applicable law.

If the product is used in a manner not specified by the manufacturer, the protection provided by the product may be impaired.

1.2 Warnings

1. **DANGER! HIGH VOLTAGE!** This system requires a 1,000- to 3,000-V DC power supply for operation and is, therefore, a source of high voltage. The power supply should have earth/ground leakage protection and open-circuit sensing. Although equipped with a safety interlock system, this equipment should always be operated with extreme caution. Careless handling can result in electrical shock.
2. Never operate damaged or leaking equipment.
3. Always turn off the DC power source prior to disconnecting DC power cords from the sequencing apparatus. Disconnect power cords from the power source first, and then from the apparatus.
4. For maximum safety, always operate this system in an isolated, low-traffic area, not accessible to unauthorized personnel.
5. Before applying DC power to this equipment, make sure that all electrical connections are secure and that power cords show no signs of damage. See Chapter 7 for further information.
6. Certain reagents indicated for use in this manual are of a hazardous nature. The researcher is cautioned to exercise care when handling these reagents. The equipment used in these procedures (*e.g.,* high voltage power supplies) should be used following the manufacturer's safety recommendations.

2 Overview

2.1 Description

The Model S2 Sequencing Gel Electrophoresis Apparatus is designed for vertical polyacrylamide gel separations of the products of dideoxy and chemical sequencing reactions. The system is useful for preparative purifications of oligonucleotides, DNA footprinting procedures, ribonuclease protection assays, and sequence determinations of up to 250 to 350 bases. This manual provides operating instructions for the Model S2 Apparatus.

2.2 Components

The Model S2 Apparatus is designed for easy assembly and reliable performance. Please refer to figure 1 to identify the following principal features and components:

- Electrophoresis apparatus with upper buffer chamber, buffer chamber drain valve, silicone gasket, removable lower buffer tray, integral gel clamps, and safety lids
- One pair of 122-cm (48-in.) DC power cords
- One pair of glass plates (one short, one long)
- One pair of 0.4-mm thick vinyl side spacers
- One pair of 0.35-mm thick mylar side spacers
- Package of four 0.4-mm thick vinyl sharkstooth combs
- Package of two 0.35-mm thick mylar sharkstooth combs
- Package of 12 adhesive-backed foam blocks for side spacers
- One roll of gel sealing tape
- Instruction manual
- S2 Casting Clamp (optional)

Many of these components are also available separately. Refer to Chapter 6, Related Products for ordering information.

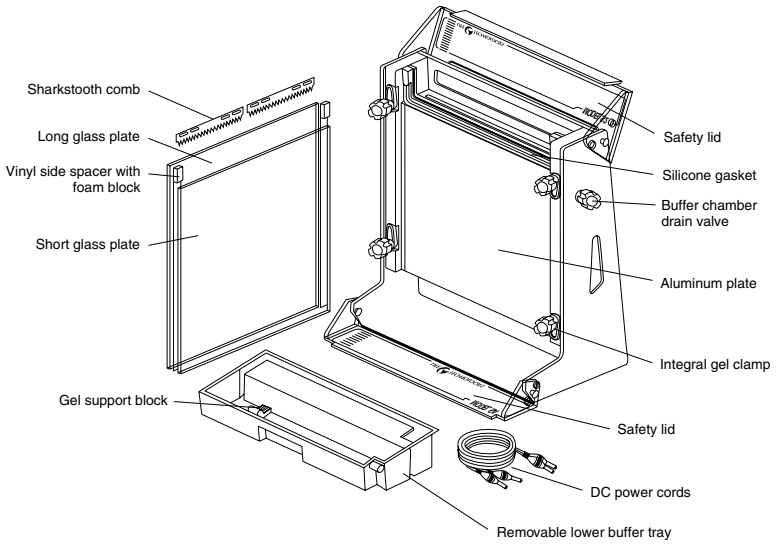

Figure 1. Model S2 Sequencing Gel Electrophoresis Apparatus.

Operating Instructions

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This chapter provides operating instructions for the Model S2 Apparatus. For a list of references containing formulations of buffers and acrylamide solutions, as well as other applications information for polyacrylamide gel sequencing and fragment purification, see Chapter 5, References. Please read all of the following instructions before using the Model S2 Apparatus. Review figure 1, as needed, to identify features and components discussed in these instructions.

3.1 Gel Casting

Gels can be cast after assembling the glass plates and spacers using Gel Sealing Tape or the S2 Casting Clamp. These techniques are appropriate for casting polyacrylamide gels.

3.1.1 Preparation of Glass Plates Using Gel Sealing Tape

1. Select a pair of glass plates (one long, one short). Be sure that the edges to be sealed with tape are free of nicks or chips.
2. Clean the glass plates thoroughly with a nonabrasive detergent and a plastic scouring pad. The cleaning solution should not leave a soap residue when rinsed thoroughly. Avoid scratching the surface of the glass plates.

   Note: *Never* use steel wool to scrub the glass plates.
3. Rinse the glass plates thoroughly with deionized water and wipe dry.
4. If desired, treat the inside (acrylamide contact) surface of one or both glass plates (usually the short plate) with a siliconizing reagent, following the manufacturer's instructions.
5. Immediately before assembling the glass plate "sandwich", rinse the inside surfaces with ethanol and wipe them dry with a lint-free paper towel. Avoid touching the inside surfaces with your fingers.
6. Assemble the glass plate sandwich in the conventional manner: place the long glass plate inside-up on the bench, align the vinyl side spacers at the sides, and place the short glass plate inside-down on the side spacers. Make sure that the foam blocks at the tops of the side spacers are snug against the top of the short glass plate and that the ends of the side spacers are 4 to 7 mm short of the bottom of the assembled plate sandwich.

   Note: Before using vinyl side spacers for the first time, attach a foam block at one end of each spacer. Remove the protective backing from the adhesive side of a foam block, align the end of the block with the end of the side spacer, and press the block firmly into place. Foam blocks may be replaced, as needed, using the extras provided with the Model S2 Apparatus.
7. Seal the sides and bottom of the assembled glass plate sandwich with gel sealing tape, as shown in figure 2. Tape the sides first (a, b) and then the bottom (c). Extend the tape around the bottom corners in both directions to ensure an adequate seal. Apply the tape as smoothly as possible to avoid forming air channels or bubbles along the edges of the glass plates. Rub the tape firmly onto glass to eliminate air channels and ensure a liquid-tight seal.
8. Place two accessory spring clips (available separately) along each side near the middle and bottom of the glass plate sandwich. This will help maintain uniform gel thickness while pouring the gel. It is important that the spring clips be placed over the side spacers *only*. Clamping unsupported glass will distort the thickness of the gel.

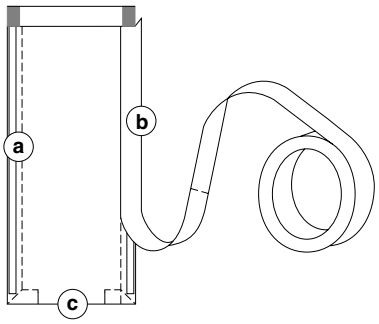

Figure 2. Taping Glass Plates.

3.1.2 Preparation of Glass Plates Using the S2 Casting Clamp

The S2 Casting Clamp can be used in place of the gel sealing tape and spring clips to seal the edges of the glass plates while casting the gel. Assemble the glass plates as before, and place the assembled sandwich in the casting clamp following the instructions below.

1. Make sure that the inner surface of the casting clamp is clean of all dried acrylamide and grease.
2. Hold the casting clamp vertically with your thumbs resting at the top of the molded handles and your index fingers over the molded feet, flex the clamp outward in a bow-like manner so that the bottom of the clamp can fit onto the bottom of the gel sandwich.
3. Fit the gel sandwich snugly into the bottom of the casting clamp. Start at one corner and seal towards the other corner.
4. After the gel sandwich is seated into the bottom of the clamp, fit the sides of the clamp onto the sides of the gel sandwich. Start at the bottom of one side, using your hands to smooth the clamp onto the gel sandwich. Repeat this for the other side of the gel sandwich.
5. When properly placed, the sides of the casting clamp will extend to within 4-5 mm of the top of the short glass plate (See figure 3). If the sides of the clamp should extend further than this, reposition the sides of the casting clamp so that they are at the top of the short glass plate.

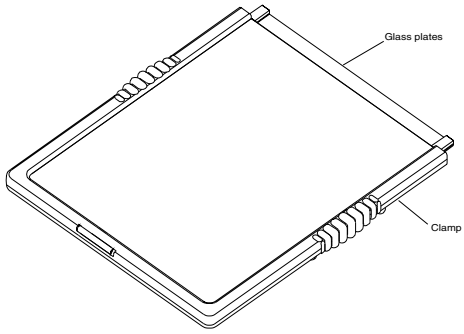

Figure 3. Assembly Using the S2 Casting Clamp

3.1.3 Pouring the Gel Using Gel Sealing Tape

1. Prepare the acrylamide gel solution (see table 1 for the approximate volumes required for different gel thicknesses).

   Note: Most gel formulations allow approximately 10 min before polymerization. Polymerization time can be extended by reducing the amount of TEMED added.

   Warning: Acrylamide is a known neurotoxin. Consult the Material Safety Data Sheet for more information.

Table 1. Approximate Gel Solution Volume Requirement for Different Gel Thicknesses.

Gel thickness (mm)	Volume required (ml)
0.2	35
0.4	65
0.8	130
1.6	260
[a]wedge	140

[a]0.4- to 1.2-mm thick

Operating Instructions

2. Use a large syringe, squirt bottle, funnel, or beaker to pour the gel solution between the glass plates. Hold the assembled plate sandwich at a 45° angle on one bottom corner so that the gel solution flows evenly down along the lower side spacer. Maintain a constant, even flow to reduce the chance of forming bubbles in the solution.
3. As the gel sandwich fills, gradually lower the glass plates until they rest on the bottom edge, approximately at a 5° angle from the bench. The gel mold should be slightly overfilled to ensure complete polymerization at the top.

   Note: If a bubble forms while the gel is being poured, raise the glass plates into a vertical position, and either tip the gel solution away from the bubble or carefully tap the plate sandwich at the bubble to make it rise to the surface. Once all bubbles have been removed, return the glass plates to their previous position.
4. Before the acrylamide polymerizes, insert a well-forming comb into the top of the gel. If you are using a sharkstooth comb, insert the *flat* edge of the comb between the glass plates to a depth of 2 to 3 mm below the top of the short glass plate (figure 4). Keep the flat edge shallow to simplify subsequent reinsertion of the comb in the sample loading (teeth-down) configuration and to allow loading with a micropipet. Mark one end of the comb so that you can keep it in the same left-to-right orientation when loading samples later. If you are using a DELRIN® square-toothed comb (available separately), insert the teeth 4 to 5 mm below the edge of the short plate.

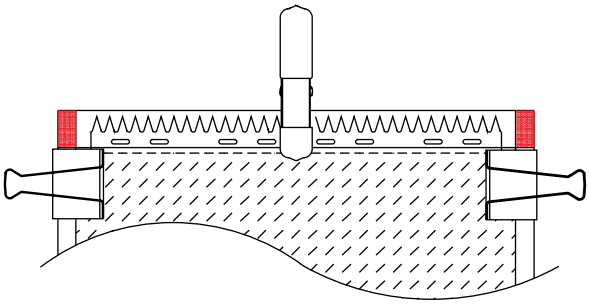

Figure 4. Gel Casting Configuration of Sharkstooth Comb.

5. A top clamp and spring clips are recommended for securing the comb/plate sandwich. Place two spring clips over the edge of the plates to clamp on the comb (figure 4). Do not place the pressure points of the spring clip over the side spacer. Place the top clamp over the top of the glass plates and clamp the center of the top edges of the plate securely against the comb. Proper placement of the spring clips and top clamp will force the plates against the comb, ensuring a tight fit of the comb following polymerization. If you use spring clips along the lower edge of the gel for sealing purposes, clamp them on the side spacers.

   Note: If spring clips are not put in place during polymerization, the comb will not fit tightly, which increases the possibility of leaks between wells.
6. Leave the glass plates in their near-horizontal position until the acrylamide has polymerized.
7. Remove the spring clips (and top clamp, if used) and tape. Carefully slide the comb from between the glass plates.
8. Rinse the top of the gel with electrophoresis buffer to remove any unpolymerized acrylamide. Rinse the comb with deionized water.

9. If you are using a sharkstooth comb, reinsert the comb between the glass plates with the teeth toward the gel. Insert the comb until the teeth just make contact with the surface of the gel (figure 5). *Do not* allow the teeth to pierce the gel. A very slight indentation of the gel should be visible when the comb is properly inserted. Do not slide the comb laterally after it has come in contact with the gel.

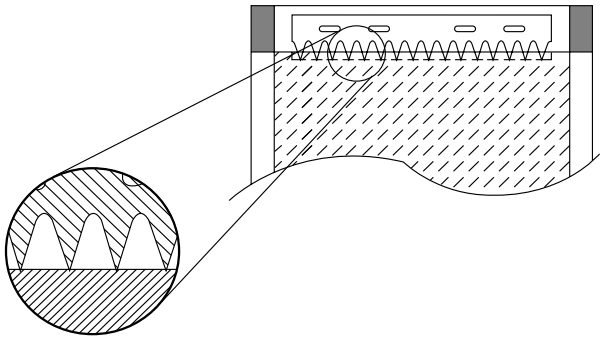

Figure 5. Sample Loading Configuration of Sharkstooth Comb.

3.1.4 Pouring the Gel Using the S2 Casting Clamp

The S2 Casting Clamp allows for the gel to be filled from either the top or the bottom of the assembled plate sandwich.

To cast the gel from the top, follow the instructions below making sure that the bottom fill port is sealed.

1. To fill the gel from the top, use a large syringe, squirt bottle, funnel, or beaker to pour the gel solution between the plate sandwich. Hold the assembled plate sandwich at a 25°-35° angle on one bottom corner so that the gel solution flows evenly down along the lower side spacer. Maintain a constant, even flow to reduce the chance of forming bubbles in the solution.
2. As the gel sandwich fills, gradually lower the casting clamp until it rests on the molded feet, approximately a 5° angle. The gel mold should be slightly overfilled to ensure complete polymerization at the top.
3. Before the acrylamide polymerizes, insert a well-forming comb into the top of the gel. If you are using a sharkstooth comb, insert the *flat* edge of the comb between the glass plates to a depth of 2 to 3 mm below the top of the short glass plate (figure 4). Keep the flat edge shallow to simplify subsequent reinsertion of the comb in the sample loading (teeth-down) configuration and to allow loading with a micropipet. Mark one end of the comb so that you can keep it in the same left-to-right orientation when loading samples later. If you are using a DELRIN® square-toothed comb (available separately), insert the teeth 4 to 5 mm below the edge of the short plate.

4 For improved comb sealing, clamp the glass plate sandwich over the comb with a top clamp over the center of the comb. It is important that the top clamp be placed over the comb only. Clamping unsupported glass will distort the thickness of the gel. The casting clamp does not require the use of accessory spring clips along the sides of the gel sandwich.

5. Leave the glass plates in their near-horizontal position until the acrylamide has polymerized.
6. Remove the top clamp (if used) and carefully slide the comb from between the glass plates.

7. Remove the glass plates from the casting clamp. Pull the casting clamp off the glass plates starting at the top and working your way down. Take care in that there may be some unpolymerized acrylamide in the bottom of the casting clamp.
8. Rinse the top of the gel with electrophoresis buffer to remove any unpolymerized acrylamide. Rinse the comb with deionized water.
9. If you are using a sharkstooth comb, reinsert the comb between the glass plates with the teeth toward the gel. Insert the comb until the teeth just make contact with the surface of the gel (figure 5). *Do not* allow the teeth to pierce the gel. A very slight indentation of the gel should be visible when the comb is properly inserted. Do not slide the comb laterally after it has come in contact with the gel.

To fill the gel from the bottom, assemble the gel plates so that when the casting clamp is laying down on the molded feet, the short glass plate is on top.

1. Place the assembled gel sandwich on a level surface resting on the molded feet of the casting clamp.
2. Open the bottom fill port and insert a Leur fitting.
3. Attach a syringe of suitable reservoir to the fitting and slowly fill the gel. Do not interupt the filling as this may introduce bubbles into the gel solution.
4. Once the gel is filled, insert the comb as before and allow the gel to polymerize.

3.2 Electrophoresis

3.2.1 Pre-Electrophoresis

1. Before beginning electrophoresis, verify that the sequencing apparatus is in a secure and level position.
2. Place the gel sandwich in the sequencing apparatus with the short glass plate inward, so that the foam blocks on the side spacers form a seal with the blue silicone gasket. Rest the bottom edge of the sandwich on the ribbed gel support blocks in the lower buffer tray.
3. Secure the gel sandwich with the integral gel clamps along the sides of the sequencing apparatus. Tighten the screw knobs firmly, but do not overtighten.
4. Verify that the upper buffer chamber drain valve is closed, and fill the upper buffer chamber with approximately 450 ml of electrophoresis buffer. Make sure no buffer is leaking from the upper buffer chamber. Fill the front chamber of the lower buffer tray with approximately 450 ml of electrophoresis buffer. Be sure no bubbles obstruct buffer contact with the lower edge of the gel.

   Note: Do not overfill the buffer chambers or allow buffer to make contact with the electrode mounting nuts.

   Warning: No buffer should leak through or around the silicone gasket or down the side of the gel assembly. Leakage may allow the upper buffer chamber to drain dry or cause sparking and damage to the apparatus. See Chapter 4, Troubleshooting, for further information.
5. Close the upper and lower safety lids and connect the DC power cords to the sequencing apparatus and the DC power supply.

   Warning: All banana plug connections must be fully seated to prevent potential sparking and fire hazards.
6. Before loading samples, pre-electrophorese the gels for 15 to 45 min (see table 2 for recommended DC power settings for various gel thicknesses). Best results are achieved with a gel surface temperature of ~50°C.

   Warning: Excessive power will cause the gel to overheat and crack the glass plates.

Operating Instructions

Table 2. Recommended Electrophoresis Power Settings for Different Gel Thicknesses.

Gel Thickness (mm)	Watts (W)	Volts (V)	Current (mA)
0.2	55	2,200–2,600	20–35
0.4	60	1,500–1,900	30–45
0.8	65	1,100–1,200	60–90
1.6	70	600–700	95–125
[a]wedge	85–90	1,200	~70

Note: Power conditions were determined for a 50°C surface temperature with 1X TBE buffer.
[a]0.4- to 1.2-mm thick.

3.2.2 Loading Samples

1. Prepare the samples by heating in an appropriate loading buffer to a temperature of 90°C to 100°C for 3 to 5 min and then chilling on ice.
2. At the end of the pre-electrophoresis period, turn off the power supply and disconnect *both* DC power cords, first from the power supply and then from the sequencing apparatus, before opening the upper safety lid.
3. Immediately prior to loading the samples, rinse the wells of the gel with electrophoresis buffer. Use a Pasteur pipette to wash away urea that has diffused into the wells.

   Note: Not rinsing the wells will prevent samples from layering properly on the gel surface.
4. Using a sharkstooth comb to form shallow wells (see Section 3.1.3) allows you to load samples with a micropipette or a drawn-out capillary pipette (figure 6). When using the sharkstooth comb provided with the Model S2 Apparatus, load 2 to 3 µl of sample per well. When using accessory doublefine sharkstooth combs, load 1.5 to 2 µl of sample.
5. When using optional square-toothed combs, load samples onto the bottom of the wells with capillary pipettes. To determine the sample loading volumes of Model S2 Apparatus square-toothed combs relative to gel thickness, see table 3.

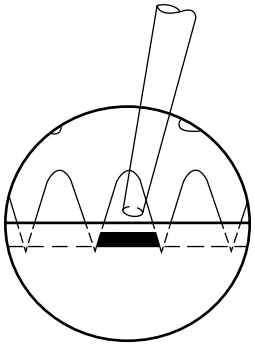

Figure 6. Sharkstooth Comb Sample Loading Technique.

Table 3. Sample Loading Volumes for Model S2 Apparatus Square-Toothed Combs as a Function of Gel Thickness.

Number of Teeth	Tooth Width (mm)	Gel Thickness (mm)	Capacity/Well (µl)
16	14.6	0.4	25
		0.8	50
		1.6	100
20	11.1	0.4	19
		0.8	38
		1.6	76
32	5.7	0.4	10
		0.8	20
		1.6	40

Note: All loading volumes are calculated for a comb insertion depth of 5 mm.

3.2.3 Electrophoresis

1. After loading the samples, close the upper and lower safety lids and connect the DC power cords to the sequencing apparatus and the DC power supply.

   Warning: All banana plug connections must be fully seated to prevent potential sparking and fire hazards.

2. Turn on the power supply and set the voltage or wattage to the proper setting for the gel (see table 2 for recommended DC power settings for various gel thicknesses).
3. Monitor the progress of electrophoresis by following the migration of a marker dye front or by any other preferred method.
4. When electrophoresis is complete, turn off the power supply and disconnect *both* DC power cords, first from the power supply, and then from the sequencing apparatus.

3.2.4 Post-Electrophoresis

1. Open the buffer chamber drain valve to allow the buffer in the upper chamber to drain into the covered rear chamber of the lower buffer tray. Open the upper safety lid and rinse the upper buffer chamber with 25 to 50 ml of deionized water to prevent buffer crystallization in the internal drain tubing.
2. Release the integral gel clamps by loosening the screw knobs and remove the gel sandwich from the sequencing apparatus. Lay the gel sandwich flat, with the short glass plate on top, on a piece of absorbent paper.
3. Open the lower safety lid and remove the lower buffer tray from the sequencing apparatus. The buffer in the open front chamber of the tray will contain any radioactive nucleotides electrophoresed out of the gel. Dispose of this liquid by pouring *away* from the drain hole in the covered rear chamber of the tray. The buffer in the rear chamber (drained from the upper chamber) may then be discarded separately. After disposing of all buffer, rinse both chambers of the tray thoroughly with deionized water and place the tray back in the sequencing unit.
4. Disassemble the gel sandwich by prying off the short (or siliconized) glass plate, working gently from a bottom corner with a thin spatula.
5. For autoradiography, transfer the gel to a solid backing, such as paper or used film.
6. Rinse combs, side spacers, and glass plates to remove buffer and gel fragments, and dry all components before storing.

4 Troubleshooting Guide

Many equipment problems can be solved by carefully following the instructions in this manual. Some suggestions for troubleshooting are given below. Should these suggestions not resolve the problem, please call the Life Technologies TECH-LINE℠ (numbers listed on the back cover of this manual). If the unit must be returned for repair, contact the Customer Service Department or your local distributor for shipping instructions. Please include a full description of the problem.

Problem	Suggested Solution
Gel Solution leaks from the bottom	Lower the angle of the glass plates when pouring the gelduring casting Check that the inner surface of the casting clamp is clean and free of debris and grease. Make sure that the glass plates are firmly seated against the inner surface of the casting clamp.
The glass plates crack	The gel is too hot. Use a lower wattage or voltage setting.
The upper buffer chamber will not drain	Check that the valve knob has been released sufficiently. Force water or buffer through the drain outlet with a syringe or pipette to remove possible dried buffer residue, airlock, or collapse in the drain tubing.
The gel dye front is not straight	Verify that the system is level. Make sure the system is not in a draft or otherwise being cooled unevenly. Verify that the buffer depth in both buffer trays is sufficient to provide complete, even contact across the full width of the gel. Verify that both electrode carriers are properly clipped in place. Make sure that the spring clips are placed over the side spacers. Distortion of the gel thickness will cause the dye front to run at different rates across the gel.
Buffer leaks from the upper buffer chamber	Verify that the top integral gel clamps are firmly, but not overly, tightened. The ribs of the silicone gasket should be slightly and evenly compressed, but not wrinkled. First, loosen the integral gel clamps a partial turn. If the leaking does not stop, try tightening the clamps carefully. Verify that the black foam blocks are securely seated against the short glass plate before casting the gel. Check the silicone gasket for tears or other damage. Verify that a pinhole leak or crack has not developed in the glue joints of the upper buffer reservoir.
Sparks or burn marks appear at edges of aluminum plate	Buffer is leaking from the upper buffer chamber. See preceding comments.

The following information addresses some of the causes of the common problems for sequencing gel electrophoresis.

Problem	Possible Cause	Suggested Solution
Blurry bands	Urea diffusing into the wells	After pre-electrophoresis, wash the urea from the wells before loading the samples.
	Formamide in sample buffer degraded	Remake sample buffer with fresh formamide.
	Excessive salt in the sample	Ethanol precipitate DNA with ammonium acetate and ethanol.
	Radiolabel properties lead to scattering of signal	Try ^{35}S- or ^{33}P-labeled dNTP's instead of ^{32}P-labeled dNTP's.
		Label the sequencing primer with T4 polynucleotide kinase instead of internal labeling.
		Use a shorter exposure.
		Use cassette that assures tight contact of gel to film.
		Do not use an intensifying screen.
	Gel was overloaded	Load less sample.
		Shorten exposure.
	Urea diffused out of gel	Do not store precast gels under electrophoresis buffer overnight in the sequencing unit.
Smeared bands	Sample electrophoresing with the ion in front	Pre-electrophorese gel until the current starts to drop (generally > $^1/_2$ hour).
	Gel temperature too high	Do not electrophorese gel on constant current. Use constant power to maintain gel at 45–50°C. (Use a surface thermometer during electrophoresis.)
	Sample electrophoresing at the surface of	Thoroughly rinse residual siliconizing agent off glass plates. Ethanol wipe the acrylamide, instead of through gel before using.
		Thoroughly wash new glass plates with a strong lab soap before using.
	Formamide in sample buffer degraded	Remake sample buffer with fresh formamide.
	Excessive salt in the sample	Ethanol precipitate DNA with ammonium acetate and ethanol.
Wavy bands	The surface of the gel did not polymerize evenly	Recast gel with extra acrylamide at the top of the gel.
		Clean the flat edge of the sharkstooth comb.
	Sharkstooth combs punctured the surface of the gel	Insert sharkstooth comb only to the point of dimpling the surface
Glass plates crack during electrophoresis	Gel is too hot	Electrophorese with constant voltage or power, not constant current.
		Do not exceed settings that yield a gel surface temperature of 45–50°C.
Lack of resolution in the upper half of the gel	Limitations in the resolving capabilities of acrylamide	Use a buffer gradient gel.
		Use wedge spacers.
		Do a double loading.
	Capsules used to make 10% ammonium	Use ammonium persulfate powder to make solution. Alternatively, remove persulfate solution the gelatin capsule from the ammonium persulfate capsule before dissolving (12).
Smiling gels (Corresponding bands in outer lanes electrophorese slower than inner lanes)	Gel thickness is not uniform	Allow the gel to polymerize at a 5° angle instead of flat.
	Gel temperature is not uniform	Use an electrophoresis unit with an aluminum plate to disperse heat evenly.
Frowning gels (Corresponding bands in outer lanes electrophorese faster than inner lanes)	Improper clamping during casting of the gel	Apply the pressure points of the binder clips only over the spacer.
		Polymerize the gel at an angle of <10°.
	Improper clamping of the gel into the electrophoresis chamber	Do not over tighten clamps on the apparatus.
		Make sure that spacers are pushed against the polymerized acrylamide.
Lanes curve outward toward bottom of the gel	Improper gel casting	Do not use bottom clamps without a bottom spacer.
		Do not pull plates together while taping the gel.
Bands are not even from lane to lane	Gel sandwich is not level	Make sure glass plates are seated flat in the electrophoresis unit.
		Make sure the gel electrophoresis unit is level.

5

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10. Smith, A.J.H. (1980) *Methods Enzymol. 65,* 560.
11. Tullius, T.C., Dombroski, B.A., Churchill, M.E.A., and Kam, L. (1987) *Methods Enzymol. 155,* 537.
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Related Products

6

Product	Cat. No.
Accessories:	
Spacer Set	
Complete with two side spacers and 12 foam blocks	
0.19-mm thick (Mylar)	21105-309
0.35-mm thick (Mylar)	21105-366
0.4-mm thick	21108-014
0.8-mm thick	31109-010
1.6-mm thick	31109-028
Bottom Spacers	
0.4-mm thick	21105-077
0.8-mm thick	21105-069
1.2-mm thick	21105-325
1.6-mm thick	21105-051
Wedge Spacer Set Complete with two 0.4- to 1.2-mm thick side spacers and 12 foam blocks	21107-016
Comb and Spacer Set Complete with two spacers and two Mylar 0.4-mm thick combs	21105-341
Spacer Foam Blocks (pkg. of 12)	21965-017
Analytical DELRIN Combs	
16-tooth: 0.4-mm thick	21035-043
0.8-mm thick	21035-050
1.6-mm thick	21035-068
20-tooth: 0.4-mm thick	21035-076
0.8-mm thick	21035-084
1.6-mm thick	21035-092
32-tooth: 0.4-mm thick	21035-100
0.8-mm thick	21035-118
1.6-mm thick	21035-126
Custom DELRIN Combs	Please call the TECH-LINE
14-cm Mylar Sharkstooth Comb	
25-pt., 0.19-mm thick (pkg. of 6)	21105-317
25-pt., 0.35 mm thick (pkg of 6)	21105-341
28-cm Mylar Sharkstooth Comb 62-pt., 0.35 mm thick	21135-134
14-cm Vinyl Sharkstooth Comb 25-pt., 0.4-mm thick (pkg. of 6)	21045-018
28-cm Vinyl Sharkstooth Combs 50-pt., 0.4-mm thick (pkg. of 2)	21046-016
14-cm Vinyl Doublefine Sharkstooth Combs 49-pt., 0.4-mm thick (pkg. of 4)	21045-026
Glass Plates (pair)	11034-014
S2 Casting Clamp	21105-432
S2 Casting Clamp (pkg. of 2)	21105-473
Gel Sealing Tape (1.5-in. × 72-yd.)	
1 roll	11032-018
10 rolls	11032-026
Spring Clips (pkg. of 12)	11098-019
Top Clamp	21047-014

Related Products

Product	Cat. No.
Replacement Parts:	
Power Cords (48-in., pair) (except Europe)	11099-041
Power Cords (48-in., pair) (Europe only)	11099-025
Silicone Gasket	21960-018
Lower Buffer Chamber Banana Plug Replacement Kit	21105-101
Upper Buffer Chamber Banana Plug Replacement Kit (see figure 7) (Includes cap nut, O-ring and Banana Plug)	21105-127
Upper Platinum Wire with Carrier	21113-014
Lower Platinum Wire with Carrier	11114-014
Upper Buffer Chamber Lid	31115-017
Lower Buffer Chamber Lid	11116-019
Gel Clamp Replacement Kit	11958-352
Drain Hose Replacement	21121-017
Drain Knob Replacement Kit (Includes knob, 4 flat washers)	21120-019
Reagents:	
GEL-MIX® 6 6% Sequencing Gel System	15543-010
GEL-MIX 8 8% Sequencing Gel System	15545-015
GEL-MIX RUNNING MATE® 10X TBE Buffer	15546-013

Additional power supplies, prepared acrylamide solutions, buffers, and other reagents for use with the Model S2 Apparatus are available. Please consult the *Life Technologies Catalogue and Reference Guide* for additional information.

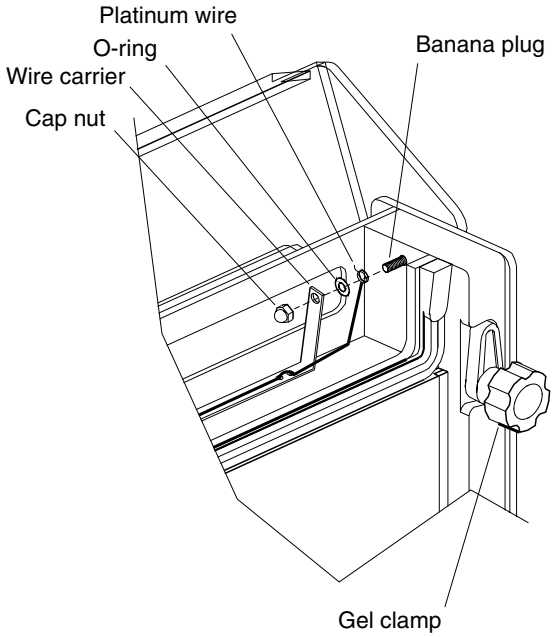

Figure 7. Upper Platinum Wire with Carrier.

Additional Information

7

7.1 Care and Handling

The components of the Model S2 Apparatus are fabricated from ABS, acrylic, vinyl, glass, silicone, and aluminum. As with any laboratory instrument, adequate care ensures consistent and reliable performance.

After each use, rinse buffer chambers, glass plates, combs, and side spacers with deionized water. Wipe dry with a soft cloth or paper towel, or allow to air dry. Whenever necessary, all components may be washed gently with water and a nonabrasive detergent, and rinsed and dried as above. To remove grease and oils, use a light application of hexane, kerosene, or aliphatic naphtha. *Never* use abrasive cleaners, window sprays, or scouring pads to clean the components, as these cause surface damage.

Additional cautions:

- Do not autoclave or dry-heat sterilize the apparatus or components.
- Do not expose the apparatus or components to phenol, acetone, benzene, halogenated hydrocarbon solvents, or undiluted laboratory alcohols.
- Avoid prolonged exposure of the apparatus or components to UV light.

7.2 Maintenance

The following simple, routine inspection and maintenance procedures will help ensure both the safety and the performance of the Model S2 Apparatus. For ordering information for replacement parts, refer to Chapter 6 or call the TECH-LINE.

1. Electrical connections:
    - Inspect electrical connections and power cords regularly. If the banana plug connectors to either the unit or the power supply do not exhibit reasonable friction or can be rocked easily, replace the plugs or power cords.
    - If power cords show any signs of wear or damage (*e.g.,* cracks nicks, abrasions, or melted insulation), replace them immediately.
    - Examine the electrode mounting nuts to ensure that they are tight and free of corrosion. If mounting nuts are corroded, they should be replaced.
2. Gaskets:
    - Regularly inspect the silicone gasket for cuts or tears and replace, as needed.
3. Aluminum plates:
    - After each use, rinse the aluminum plates thoroughly with deionized water to remove salts and urea. Failure to keep plates properly clean may affect performance and introduce a potential electrical hazard.

Additional Information

7.3 Specifications

"Installation Category I"

Weight ..... 6.32 kg (13.9 lb.)
Apparatus Dimensions (W × D × H) ..... 42.2 × 21.6 × 44.5 cm (16.6 × 8.5 × 17.5 in.)
Gel dimensions (W × H) ..... 31.0 × 38.5 cm (12.2 × 15.2 in.)
Construction ..... Flame retardant ABS, acrylic, aluminum, silicone
Electrode material ..... platinum
Maximum gel thickness ..... 1.6 mm
Working buffer volume ..... 1 L
Comb (included) ..... 14-cm sharkstooth, 25-pt., 0.4-mm thick
Voltage Range ..... 2000 VDC Max
Current Range ..... 0-125 mA, 0.5 A Max
Operating Temperature Range ..... 4-30°C (non-condensing atmosphere)

7.4 Warranty

Life Technologies, Inc. warrants apparatus of its manufacture against defects in materials and workmanship, under normal service, for one year from the date of receipt by the purchaser. This warranty excludes damages resulting from shipping, misuse, carelessness, or neglect. Life Technologies' liability under the warranty is limited to the repair of such defects or the replacement of the product, at its option, and is subject to receipt of reasonable proof by the customer that the defect is embraced within the terms of the warranty. All claims made under this warranty must be presented to Life Technologies within one year following the date of delivery of the product to the customer.

This warranty is in lieu of any other warranties or guarantees, expressed or implied, arising by law or otherwise. Life Technologies makes no other warranty, expressed or implied, including warranties of merchantability or fitness for a particular purpose. Under no circumstances shall Life Technologies be liable for damages either consequential, compensatory, incidental, or special, sounding in negligence, strick liability, breach of warranty, or any other theory, arising out of the use of the product listed herein.

Life Technologies reserves the right to make improvements in design, construction, and appearance without notice.

7.5 Declaration of Conformity and CE Mark

Note: The information outlined in this section applies only to customers located in the European Union (EU). The EU is currently comprised of 15 member countries.

This laboratory apparatus is identified with the **CE** mark. This mark indicates that the product complies to the following EU Directives and Standards:

Application of Council Directive(s):
73/23/EEC Low Voltage Directive

Standards:
EN 61010-1:1993 Product Safety

EU Representative:
Life Technologies Ltd.

EU Address:
3 Fountain Dr.
Inchinnan Business Park
Paisley, PA49RF Scotland

A copy of the Declaration of Conformity certificate is available upon request.

Part No. 10451

Lot No. 1088518